An Empirical Analysis of Medicare-eligible Veterans' Demand for Outpatient Health Care Services*

Kajal Lahiri and Guibo Xing

Department of Economics, University at Albany–SUNY

Albany, NY 12222, USA

Abstract: Using data from the *1992 US National Survey of Veterans*, we analyze Medicare-eligible veterans' use of VA and non-VA outpatient health care services. We apply a utility consistent, combined multinomial choice and count data model to identify factors that affect these veterans' outpatient health care usage and facility choices, with special reference to the effect of out-of-pocket cost, distance to the medical facility, and supplemental private medical insurance coverage. Our first stage count data regression shows that the out-of-pocket cost index calculated from the second stage multinomial choice model is significant in determining the Medicare-eligible veterans' demand of outpatient health care services. The calculated cost index elasticity of outpatient visits is about -0.65. In the second stage, we specify a multinomial choice model to study veterans' allocation of outpatient visits between VA and non-VA health care facilities, and we find that veterans' out-of-pocket cost and the distance to the health care facility have significantly negative effects on the probability of choosing the alternative. A number of other factors including family income, insurance status, means of transportation, home ownership, race, employment, health, disability status and diagnostic conditions were also found to be important at various stages of the decision making. We find no evidence of adverse selection in the market for supplemental private health insurance. The model is used to simulate the impact of alternative copayment policies on the demand for VA outpatient health care services.

KEY WORDS: National Survey of Veterans, Health Care Demand, Two Stage Count Data Model, Nested Logit, Copayments, Shadow Cost, Consumer Surplus, CBOCs.

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*Corresponding author: K. Lahiri, Department of Economics, University at Albany–SUNY. Albany, NY 12222, USA. Email: KLahiri@albany.edu; Phone: (518) 442-4758; Fax: (518) 442-4736

1 Introduction.

Veterans who are 65 or older are eligible for health insurance under Medicare. These elderly veterans have the highest medical care usage among all veterans. They also form a substantial portion of the Veterans' Administration (VA)'s user group, accounting for almost half of veterans using the VA health care system. Given the aging of veterans, the proportion of elderly veterans has been increasing during past few decades. Due to the overlap in their health insurance coverages, elderly veterans' health care service demand is expected to be affected by both Medicare and VA health care policies. According to the Veterans' Equal Access to Medicare Act (1999), and the Veterans Medicare Reimbursement Demonstration Act (2000) passed recently by Congress, the VA is now authorized to demonstrate the feasibility of allowing Medicare-eligible veterans to utilize their medicare benefits in the health care system of the Department of Veterans Affairs. This new reimburement policy has the potential of increasing the scope and the quality of the VA health care system. Thus, analyzing Medicare-eligible veterans' health care utilization patterns between VA and non-VA facilities can have significant implications both for public health care reform for the elderly and for the financial viability of the VA health care system.

Although the VA's health care system was initially designed and built mainly for inpatient care, the VA has began to redesign its system to treat more veterans in so-called community-based outpatient clinics (CBOCs) closer

to where they live. The bulk of medical care is now provided in outpatient clinics. Currently, VA operates more than 800 ambulatory care and community-based outpatient clinics. In this paper, we will concentrate on analyzing veterans' outpatient health care utilization.[1]

We propose an empirical model to examine factors that determine Medicare-eligible veterans' use of health care services and their choices between VA and non-VA health care alternatives. In important papers, Deb and Trivedi (1997), Ettner (1997), Hurd and McGarry (1997), Nemet and Bailey (2000), and Schellhorn *et al.* (2000), among others, have studied the health care utilization of the elderly from different perspectives, but none considered the role of additional treatment facility choice on the total medical care use. Following Hausman, Leonard and McFadden (1995), we use a two-stage structure for health care demand. In the first stage, we analyze factors that determine an elderly veteran's total demand for outpatient health care services. In the second stage, we address veterans' allocation of outpatient service demand to each of the alternatives. The two stages are linked by a cost index for visits that is derived from the second stage and used in the first stage as a determinant of total outpatient services demand. The cost index is computed as the negative of the consumer surplus obtained from the second stage of choice. The allocation of visits among different alternatives is based on, among other variables, the actual out-of-pocket cost of the individual to the alternative

[1] An 'outpatient' visit in the VA system includes what the fee-for-service system considers visits to physicians offices and free- standing health clinics as well as visits to hospital emergency rooms.

and the distance between the individual residence and the alternative facility. The second stage is estimated first, as a multinomial choice model. A cost index is then computed and used as an explanatory variable in estimating the first stage model, which is specified as Negative Binomial Type 2 (NB2) count data model. The entire two-stage framework is utility consistent in that it can be derived from utility maximization.

The two-stage framework was used by Hausman *et al.* (1995) to model the joint determination of the choice of recreational sites and the number of recreational trips. Using this model, they estimated the welfare loss suffered by recreational users due to natural resource damage. In recent years, count data models have been successfully utilized to analyze health care demand, but the role of the shadow cost index for alternative visits in determining the total demand of health care by combining count data models with multinomial choice models has not been explored before.[2]

The major data source used in our analysis is the *1992 National Survey of Veterans (NSV 1992).* The survey data file includes information on veterans' demographics, health status, health care utilization, health insurance coverage and program participation, and so on. We also used some recent data from HCFA and the Department of Veterans Affairs (VA) to supplement our analysis.

A very limited number of papers have analyzed the health care utilization patterns of veterans. A report by the General Accounting Office [GAO/

[2]See, for example, Cameron *et al.* (1988), Pohlmeier and Ulrich (1995), Gurmu (1997), Windmeijer and Silva (1997), and Yen, Tang, and Su (2001).

HEHS-95-13] analyzed the use of VA health care services by Medicare-eligible veterans. It looked at the effect of Medicare insurance on the usage of VA health care services by veterans. Another GAO report [GAO/HEHS-96-13] analyzed how the distance a veteran lives from a VA hospital or outpatient clinic affects his use of VA health care services. Burgess and DeFiore (1994), and Mooney *et al.* (2000) also analyzed the effect of distance on veterans' health care utilization. Hoff and Rosenheck (1998) examined whether female veterans differed from male veterans on the likelihood of using any VA health care facilities. These papers on veterans' health care utilization examined the effect of only a few factors on veterans' health care utilization. In our analysis, we estimate the effect of a number of factors that affect veterans' demand for VA as well as non-VA health care, with special reference to the role of out-of-pocket costs, distances, and supplemental private health insurance coverage on the total demand for outpatient health care.

In the next section, we introduce the two-stage model and estimation methods. In section three, we introduce the survey data and discuss some of the features of different health care programs. The rationale behind the choice of variables and the estimation results are also presented in section three. Section four contains a summary and the conclusions.

2 The Model

Hausman *et al.* (1995) specified a two-stage model of recreation demand, which combines a discrete choice model with a utility consistent count data

model. They stated that the model, which conforms to a two-stage budgeting process, may be useful in many other consumer choice situations. First a multinomial model for explaining the choice of recreational sites is specified and estimated. The estimates from this step are used to construct a price index for recreational trips. This price index subsequently becomes an explanatory variable in the count model for total number of trips. We will use this framework in our empirical analysis.

In the first stage, we study factors that affect a veteran's total outpatient health care service demand. In the second stage, we address his allocation of outpatient visits between VA and non-VA facilities. The allocation process itself is specified as a two-level nested logit model. The first level explains zero/non-zero health care usage in a particular year. Upon positive usage, the second level explores the allocation between VA facilities and non-VA facilities. In the first stage, veterans' total demand for outpatient services is affected by the out-of-pocket cost index for each visit. The negative of the consumer surplus obtained from the second stage is used as the cost index. The allocation of visits among different alternatives is based on, among other factors, the actual out-of-pocket cost of the alternative to the individual, and the distance between the individual's place of stay and the alternative. The second stage is estimated first, as a nested multinomial logit model. A cost index is then computed and used as an explanatory variable in estimating the first stage model, which is specified as NB2 count data model.

2.1 Econometric Specification of the Visits Allocation Decision

The second-stage decision involves the allocation of outpatient visits to different health care service alternatives. In 1992, 36 percent of veterans' outpatient visits were to VA health care facilities, and 64 percent to non-VA health care facilities. But in that year 22 percent of veterans did not seek any outpatient health care service.

The allocation model is estimated as a two-level nested multinomial logit model. The first level consists of the choice of zero vs. non-zero health care usage. Upon positive usage, at the second level, a veteran allocates his utilizations between two alternatives: VA facilities and non-VA facilities. It is important to distinguish between the two levels because the stochastic processes governing them could be quite different.

The nested multinomial logit model (NMNL) is composed of several multinomial choice models (MNL) parallel or nested to one another. To describe the structure of NMNL, it is useful to start with the lower level of MNL. Following Hausman and Wise (1978), we define the random utility of each individual over each of the choice alternatives:

$$U_{ij} = Y_i\alpha_j + X_{ij}\beta + \varepsilon_{ij} \tag{2.1}$$

where Y_i is a vector of characteristics unique to individual i. X_{ij} is a vector of characteristics unique to choice (or branch) j with respect to individual i. α_j and β are vectors of parameters to be estimated, and ε_{ij} are distur-

bance terms. The multinomial logit model specifies vector $(\varepsilon_{i1}, \varepsilon_{i2}, ..., \varepsilon_{iJ})$ to come from an independently and identically distributed type I extreme value distribution.

For the multinomial logit model, only one coefficient is estimated per characteristic of the alternatives; for characteristics that vary by individuals, (J-1) coefficients must be estimated per characteristic, where J is number of choices. So in the two alternative case, we estimate one coefficient per individual characteristic, which is the effect of a change in the variable on the utility of choosing alternative one relative to choosing alternative two.

Conditional on having chosen branch k (for instance, positive outpatient usage), the probability of individual i choosing alternative j (VA or non-VA) is:

$$P_{ij|k} = \frac{\exp(Y_i\alpha_j + X_{ij}\beta)}{\sum_{j=1}^{J_k} \exp(Y_i\alpha_j + X_{ij}\beta)} \tag{2.2}$$

where J_k is the number of alternatives in branch k. Define IV_k , the inclusive value for branch k, as:

$$IV_k = \ln(\sum_{j=1}^{J_k} \exp(Y_i\alpha_j + X_{ij}\beta)) \tag{2.3}$$

Define, P_k, the probability of individual i choosing branch k, as:

$$P_k = \frac{\exp(Y_i\xi_k + X_{ik}\eta + IV_k\gamma_k)}{\sum_{k=1}^{K} \exp(Y_i\xi_k + X_{ik}\eta + IV_k\gamma_k)} \tag{2.4}$$

where K is the total number of branches. The probability of individual i choosing alternative j , P_{ij}, is

$$P_{ij} = P_{ij|k} P_k \tag{2.5}$$

If T_{ij} is the number of visits by individual i to alternative j, then the log likelihood is

$$\log L = \sum_{i=1}^{I} \sum_{j=1}^{J} T_{ij} \log P_{ij} \tag{2.6}$$

The per visit consumer surplus for each individual is calculated as

$$S_i = \frac{1}{\delta} \ln(\sum_{k=1}^{K} \exp(Y_i \xi_k + X_{ik} \eta + IV_k \gamma_k)) \tag{2.7}$$

where δ is the absolute value of the coefficient of the out-of-pocket cost in the allocation model (See Hausman *et al.*,1995, pg. 9).

An individual's "consumer surplus" is the difference between the most he would be willing to pay for a good and what he actually pays. The calculation of consumer surplus from discrete choice models was first suggested by McFadden (1981) and Small and Rosen (1981), and it was further developed by Small (1992), McConnell (1995), and Choi and Moon (1997) in different model specifications. The inclusive value in discrete choice models is directly related to consumer's surplus. For the nested logit model, the inclusive value measures the expected maximum utility of the alternatives in a nest or the social surplus from the choice of a nest, see Dubin (1998, Chs. 6, 7).

2.2 Econometric Specification of the Total Outpatient Visits

A veteran's outpatient health care service demand is affected by, among other things, his demographics, morbidities, supplemental health care insurance, and a shadow cost index representing the price of each visit. As in Hausman *et al.* (1995), we can use the consumer surplus measure from the allocation model as the shadow cost index. Since the allocation model is nested under the total number of visits model, it is natural to use the visit allocation inclusive value in the decision higher up in the tree. Hausman *et al.* (1995) showed that this choice of price index is consistent with two-stage budgeting.

Since the number of outpatient visits is an integer greater than or equal to zero, an appropriate specification is the count regression model (Hausman *et al.,* 1984; Cameron and Trivedi, 1998). The count model specifies the conditional expectation of the count random variable to be

$$E[T_i \mid X_i] = \exp(X_i\beta) \tag{2.8}$$

where, T_i is the total of outpatient visits, X_i is the vector of variables which affect total outpatient demand, including the cost index, and β is the coefficient vector.

The most basic count data model is the Poisson regression model, but if the data is over-dispersed, the negative binomial (NB) model is used to deal with the overdispersion. For the NB2 specification, the probability of

an individual having a total of t_i outpatient visits is:

$$P(T_i = t_i) = \frac{\Gamma(t_i + \alpha)}{\Gamma(\alpha)\Gamma(t_i + 1)}(\frac{\alpha}{\alpha + \varphi_i})^{\alpha}(\frac{\varphi_i}{\alpha + \varphi_i})^{t_i} \tag{2.9}$$

where $\varphi_i = \exp(X_i\beta) = E[T_i \mid X_i]$, and α is the overdispersion parameter. Maximum likelihood estimation can be used to estimate β. As long as the conditional mean is correctly specified, MLE is consistent for β.

The sample mean of our dependent variable, total number of outpatient visits, is 6.17. The standard deviation is 9.39, suggesting overdispersion. The LR test statistic for overdispersion is 800.3, which far exceeds the 1% critical value of $\chi^2_{0.98}(1) = 5.4$, indicating the presence of overdispersion, see Cameron and Trivedi (1986, 1998). Here we will use NB2 model in order to control for overdispersion.

3 Empirical Results

3.1 VA and Other Major Health Care Programs

The population we covered in our analysis is Medicare-eligible veterans. This means that all of them are necessarily covered by Medicare Part A (inpatient). Nearly 4 percent of them are also covered by Medicaid, and 66 percent are covered by different types of supplemental private health care insurance in addition to the Medicare coverage. Patients choose different health care providers depending upon eligibility, coverage, costs, benefits, and quality of different health care systems, besides their own attributes. Thus, we need to take a close look at the difference between these programs. Because there is

a great deal of variation among different private health insurance programs, we will mainly concentrate on VA, Medicare, and Medicaid.

The VA health care system provides health care services through a 'direct care' system of hundreds of hospitals, outpatient clinics, and nursing homes. Basically, all veterans are eligible for treatment at VA medical facilities. However, payment and availability of care varies depending on the type of treatment needed, the financial situation of the veteran, and whether or not the veteran has a service-connected disability or receives a low income VA pension. The degree of disability is a factor in treatment cost and treatment priority. For example, veterans with service-connected disabilities rated at 50 percent or higher are entitled to inpatient hospital and comprehensive outpatient care, and if space and resources are available, they can also use medically necessary nursing home care. Veterans with service-connected disabilities rated 50 percent or less are also entitled to inpatient hospital care, but their entitlement to outpatient care is more limited; most of them are entitled only to treatment of their service-connected disabilities, and other outpatient services can be provided only if space and resources are available.

The availability of services to veterans without service-connected disabilities is more complex. The VA uses veterans' income and assets to determine which of these non- service-connected veterans are (1) entitled to inpatient hospital care, and (2) required to make copayments for both inpatient and outpatient services. Veterans with income below certain thresholds, with service-connected disabilities, who are former prisoners of wars, and of cer-

tain other types are placed in the mandatory-care category. Veterans eligible for Medicaid or receiving VA pensions belong to the mandatory-care category. The rest are placed in the discretionary-care category, but can still obtain care if space and resources are available and if they agree to make the copayments.

Medicare is a federal health insurance program covering almost all Americans aged 65 and older, and certain individuals under 65 who are disabled (under Social Security Title II) or have chronic kidney diseases. The Medicare program is composed of two parts: hospital insurance, called Part A, and supplementary medical insurance, called Part B. Part A helps patients pay for inpatient hospital care, post-hospital care in skilled nursing facilities, post-hospital home health services, and hospice care. Part B supplements Part A by helping pay for doctor's services, outpatient services, and a number of other medical services and supplies. Participation in Part B is voluntary with a monthly premium of $31.80 per month (in 1992).

Medicaid is a jointly funded federal-state program that pays for health care services to low-income individuals, and to those under the SSI disability program. Medicaid is operated by states under the general oversight of HCFA. Each state has considerable flexibility in determining who will receive Medicaid assistance, what services will be provided to them, and what limits will be placed on those services. In addition to the categorically needy, states can cover the medically needy under the Medicaid. Persons become medically needy only after they have incurred medical expenses significant

enough to reduce their income and resources to the medically needy levels.

Although the above three programs have different target populations, there are overlaps. For example almost 50 percent of veterans are eligible for Medicare, and about 4 percent are eligible for Medicaid. This causes people to have multiple program coverage. Needless to say, the benefit and cost of each program are very important in determining veterans' choice for each health care system.

The VA direct care system has no limitation on the days allowed for medically necessary care for the mandatory category patients. Medicare limits coverage of inpatient medical and surgical care to 90 days during any benefit period, and it allows for 60 extra hospital days. Two-thirds of Medicaid recipients have no limits on their days of care, while the other one-third have limits ranging from 14 to 60 days. The limits on days of inpatient care under Medicare could result in Medicare-eligible veterans with serious illness seeking care from VA once their Medicare coverage has been exhausted.

VA and Medicare do not have limits on the number of outpatient visits, but in some states Medicaid limits one clinic or physician visit per day. Although VA does not have limits on the number of outpatient visits, VA's eligibility and entitlement provisions place significant limits on the availability of routine outpatient care. For most veterans, outpatient care is limited to services needed to prepare for or obviate the need for hospitalization or as a follow up to hospitalization. Only very old veterans or those with service-connected disabilities rated at 50 percent or higher are guaranteed

comprehensive outpatient care.

Neither VA nor Medicare has limits on outpatient mental health care. However, because outpatient mental health benefits are covered under Medicare Part B, veterans who do not enroll in Part B would be more likely to depend on VA for such care.

All major health care programs cover inpatient and outpatient treatment for substance abuse, but only VA does not have limits on coverage for medically necessary care. Medicare provides unlimited coverage for outpatient care but applies inpatient mental health limits to substance abuse treatment stays. Alcohol and drug abuse are among the most significant health problems for some veterans. Because of the coverage limits in other health benefits programs, VA plays an important role in meeting those treatment needs. VA and Medicaid provide some dental and vision care, but Medicare does not. This could lead some veterans to seek dental and vision care from theVA.

As for private health insurance coverage of our sample members, the 1992 veterans' survey shows that, of all the Medicare-eligible veterans, 55% were covered for doctor office visits, 38% were covered for prescription drugs, 16% were covered for dental care and drug and alcohol abuse treatment, and 24% were covered for mental health services. Medigap is a special private health insurance designed specifically to supplement Medicare coverage. Medicare-eligible veterans have to pay monthly premiums to buy desired Medigap policies from various selections. Nearly 34 percent of Medicare-eligible veterans

chose Medigap to supplement their Medicare in 1992.

As discussed above, VA generally offers more extensive benefits than Medicare and Medicaid. Because the out-of-pocket costs for non-covered services can be substantial, Medicare or Medicaid-eligible veterans have an incentive to use the VA system to supplement their coverage under Medicare or Medicaid. For example, they may use VA for items not covered by Medicare such as vision, dental care and outpatient drugs. VA and Medicaid do not charge premiums, but Medicare optional Part B charges premiums.

The deductibles and copayments under VA, Medicare, and Medicaid for inpatient, outpatient, and nursing home care are also quite different. Generally VA has the lowest cost sharing, followed by Medicaid, while Medicare has the highest cost sharing of the three. This may also give strong incentive for Medicare-eligible veterans to seek care from VA, especially if they are low-income. Taking outpatient care as an example, veterans in the mandatory-care category and most Medicaid recipients receive free VA outpatient care. Medicare, however, requires an annual deductible of $100 for each person, and copayment of about 20 percent of approved charges in 1992. Unlike the major health benefits programs that impose copayments as a percentage of the cost of services provided, VA charges veterans in the discretionary-care category a flat fee of $30 per visit (in 1992) regardless of the service provided. So if the cost for outpatient visit is higher than $150, this copayment would have been lower than the copay of Medicare.

One disadvantage of VA health care system is that it has relatively few

facilities nationwide, so it is not convenient for some veterans to seek care from the VA if they need to travel long distances. But the VA has been making progress in improving veterans' access to veterans health care. It introduced community-based outpatient clinics (CBOCs) operated by VA or by community providers through a contractual relationship with VA. This has improved access for veterans and reduced beneficiary travel time and expenditures. It has also redirected patients from medical center clinics to CBOCs, thereby shortening waiting times. VA has also made tremendous effort in allocating resources efficiently across different regions to improve access.

3.2 Dataset and Variables

The data used in our analysis come from the 1992 *National Survey of Veterans (NSV1992)*. It was conducted in 1993, and the sample consisted of 11,645 veterans nationwide. The survey covered veterans' military experience, demographics, assets and income, health status, use of medical benefits, use of compensation and pensions, use of VA programs, etc. Here we consider a sub-sample of veterans who have Medicare insurance coverage, and consider only veterans' outpatient health care demand.

Consider first the choice of variables for the second stage nested logit allocation model. This is a two-level nested logit model; in the first level the veteran decides zero/non-zero usage, and upon a positive decision, in the second level he allocates outpatient service usage to VA and non-VA health

care facilities.

At the second level of the two-level NMNL model, out-of-pocket cost of visits to each of the two alternatives is an important explanatory variable. To calculate the out-of-pocket cost, veterans' answers to two survey questions are used: 1) "was your last, second last, and third last outpatient visit during 1992 to a VA, or non-VA facility?", 2) "how much did you pay for your last, second last, third last outpatient visit?". If a veteran received outpatient services from one of the two health care alternatives, then his out-of-pocket cost for that alternative is calculated as the average out-of-pocket cost for these visits. If a veteran did not seek outpatient services from a certain alternative, his out-of-pocket cost to that alternative is calculated as the fixed cost for that insurance coverage status. For example, if a veteran belongs to a discretionary care category (or Category C), then his out-of-pocket cost to a VA outpatient facility is $30 (copayment in 1992), and his out-of-pocket cost to a non-VA outpatient facility is approximated as the average cost of those Category C veterans who visited non-VA outpatient facility. If a veteran belongs to a mandatory care category (or Category A), then his out-of-pocket cost to a VA outpatient facility is zero, and his out-of-pocket cost to a non-VA outpatient facility is approximated as the average cost of those Category A veterans who visited non-VA outpatient facilities. If a veteran is covered by Medicaid, then his out-of-pocket cost for visiting a non-VA outpatient facility is also zero. If a veteran has Medicare Part B coverage, his monthly premium is also counted into his out-of-pocket cost.

The distance from where the veteran lives to the two types of health care facilities is also an attribute that changes with the choice alternatives and individuals. The mean value of the veterans' shortest distances to VA health care facilities in our sample is 40 miles; 50 percent of all veterans live within 27 miles of a VA health care facility, and 90 percent within 100 miles. The mean value of the veterans' shortest distance to non-VA health care facilities is only 6.3 miles; 50 percent of the veterans live within 3 miles of a non-VA health care facility, and 90 percent within 15 miles of a non-VA health care facility. For those who live within 50 miles of a VA outpatient facility, the average number of visits to VA outpatient facilities is 2.5, compared to 1.5 visits for those living 50 miles or more of a VA outpatient facility. Thus, it is clear that the distance can be an important consideration in facility choice.

Apart from cost and distance, the choice of other explanatory variables in the allocation model was dictated by our discussion earlier in this section on the eligibility and benefits of VA and Medicare. Also we include various attributes and health status of different veterans. The mode of transportation to a VA facility is an important factor that can affect the facility choice and frequency of outpatient usage.

We also want to see if various diagnostic conditions affect veterans' health care provider choices. For example, we may expect that veterans with psychiatric, substance abuse, dental or vision problems will use VA care services relatively more often.

Because veterans' disability status and rating determine their eligibility

and benefits of various VA care services, in our explanatory variables we included disability status, disability rating, and service-connected disability status.

Income is another important factor in the VA health care choice. Income level determines whether a veteran belongs to mandatory or discretionary category. We expect lower-income veterans will choose VA for uncovered services because VA care has lower cost. For veterans with family income less than $20,000, nearly 34 percent visited VA outpatient facilities, and had an average 3.3 VA outpatient visits; while for veterans with family income higher than $20,000, only 0.9 percent visited VA outpatient facilities, and had an average 0.8 VA visit.

Supplemental health insurance coverage is also an important factor for veterans' choice of health care provider. We expect that if a veteran has private insurance coverage he will more likely to use non-VA outpatient services. Veterans with private health insurance coverage have on average one VA outpatient visit, compared to five VA visits for those with only public insurance coverage. The extent of private insurance coverage may also affect a veteran's use of VA or non-VA health care services. Only 4% of those veterans who are covered by private health insurance for prescription drugs visited VA outpatient facilities, compared to 34 % for those without prescription drugs coverage. So we include variables such as "whether your private health insurance covered or partly covered prescription drugs" as an explanatory variable.

Finally, we also included gender, race and employment status as explanatory variables to see if these factors have any effect on veterans' health care choices. Table 1 shows the importance of income, race, disability, and patient Category (A/C) on veterans' facility choice.

In the first level of nested logit model, we include only individual specific attributes such as veterans' demographics, health conditions, insurance status, etc. We exclude a cost variable, because only those who ever used outpatient services will have out-of-pocket cost; no costs are recorded for non-users. Most of the outpatient non-users were healthy and did not need outpatient care. But there are 2.5 percent of Medicare-eligible veterans who were unable to get needed outpatient care; one percent could not afford it, 0.6 percent were turned down at VA facility, and another 0.3 percent thought it was not convenient or had to wait too long.

The definitions and sample means of all variables used in this study are shown in Table 2. There were 2,535 Medicare-eligible veterans, and 1,928 of them had at least one outpatient visit during the recorded period. This is the total number of individuals in the second level nested logit estimation.

In the first stage, total number of outpatient visits model, we included veterans' health conditions, various diagnosed health problems, insurance status, age, gender, income, education, race, etc., besides the cost index computed from the second stage. Fortunately *NSV (1992)* contains information not only on whether a veteran has supplemental private health insurance coverage, but it also has information on whether the coverage was obtained

through an employer or was purchased directly from an insurer or an association like the AARP. Following Ettner (1997), we included a set of four dummies to examine the effects of moral hazard and adverse selection in the private supplemental health insurance market. INS_BASIC indicates basic supplemental private health insurance dummy without prescription drug coverage, INS_DRUG indicates enhanced supplemental private insurance with prescription drug coverage, ADVERSE indicates basic insurance coverage plus enhanced coverage only through an employer or ex-employer, and ADVERSE+ indicates enhanced coverage only through a non-employer source (such as AARP) or purchased directly. Persons covered through an employer are less likely to be self-selecting than those who purchase directly. Ettner (1997) showed that the coefficients of INS_BASIC and INS_DRUG measure the effects of moral hazard (insurance effect), and the coefficients of ADVERSE and ADVERSE+ measure the effects of adverse selection net of pure insurance effect. The sample includes all veterans with usable data, a total of 2,535 veterans with an average of 6.17 visits during the preceding year.

3.3 Allocation Model Results

The nested multinomial logit (NMNL) estimation results using limited information maximum likelihood method are shown in Tables 3 and 4[3]. Table 3

[3]At first, we considered estimating (2.6) - (2.9) by combining the 'allocation model' and the 'total number of counts model ' to form a simultaneous equations model of counts and discrete variables, allowing for stochastic dependencies and cross-equation restrictions. But as noted by Cameron and Trivedi (1998, Ch. 8), this approach is problematic because

presents the estimation results of the second level NMNL, i.e. the allocation of outpatient service usage between VA and non-VA health care facilities. As expected, the coefficients of out-of-pocket cost and distance - the only two alternative-specific variables in our specification - are negative, significant, and imply substantive effects. The elasticity of the probability of outpatient visit to a VA facility with regard to the out-of-pocket cost of VA visit is estimated to be -0.11, and the elasticity of VA visit with regard to the distance to the VA facility is -0.15. Burgess *et al.* (1994) found that distance affects veterans' outpatient facility choice significantly for measured distance up to 60 miles at a decreasing rate. They claim that since most veterans pay little or nothing out-of-pocket, the time and travelling cost in seeking VA outpatient care is the primary cost of service. Our results also show that the cost elasticity is indeed smaller than the distance elasticity.

The marginal effect[4] for INS_DRUG shows that if a veteran's private insurance covers prescription drugs, his chance of using the VA outpatient facility will decrease by 3 percent. Thus, if the prescription drug costs are covered by Medicare in the future, we will expect outpatient visits to VA will decrease by about 3 percent. Veterans' mode of transportation (CAR) to a VA facility is also a very significant factor in their facility choice. As noted

of the difficulty in formulating a suitable joint probability distribution.

All estimates reported in this paper were obtained using LIMDEP 7.0.

[4]Since the estimated coefficients are difficult to interpret for non-linear models, we computed marginal effects of regressors. Marginal effects of continuous explanatory variables are partial derivatives of expected value of the dependent variable with respect to the vector of characteristics, evaluated at the means of $X's$. For further explanation and the calculation of marginal effects for continuous and dummy variables, see Greene (2000, Ch19) and Christofides *et al.* (1997).

before, veterans' average distance to VA outpatient facilities is much longer than their average distance to non-VA outpatient facilities, but if their mode of transportation is car, their likelihood of choosing VA facilities is higher.

Other attributes which significantly affect veterans' VA visits are their income levels, home ownership, insurance status, age, race, employment status, and various health status variables. Low income veterans have a higher chance of VA outpatient visits than others. Home ownership is significant in all our regressions, suggesting substantive wealth effects, see Ettner (1997). Veterans who are disabled, diagnosed with mental, HBP, eye, stomach and heart problems, or accident victims also have more VA outpatient visits. This is consistent with our discussion above. In addition to INS_DRUG, Medigap and Medicare Part B induce more non-VA visits, suggesting significant moral hazard effects. Veterans who are white or have a full-time job also prefer to choose non-VA outpatient services. However, veterans with substance abuse problems tend to use more non-VA outpatient health care facilities, even though both Medicare and VA treat some of these patients with equal generously. The model fit indicator McFadden's $\overline{R}^2$ is 0.81.

Table 4 shows the estimation results of first level NMNL, i.e. the decision of whether or not to use outpatient care services. As expected, disabled veterans, veterans with diagnosed chronic health problems such as HBP, cancer, rheumatism, stomach, or mental problems, and accident related injuries have higher probability of outpatient usage. The self-rated health condition variable is not significant. This is reasonable because, being a subjective heath

condition measure, the self-rated health variable should play a less important role than some other objective health measures like disability status and diagnostic conditions in determining health care usage. Veterans who have their own home or still have a full-time job, and Category C veterans are less likely to visit outpatient health care facilities. The four health insurance variables (INS_BASIC, INS_DRUG, ADVERSE, and ADVERSE+) are all negative but not statistically significant at the 5% level. This result is consistent with the evidence in Hurd and McGarry (1997, table 4) who, based on *AHEAD* data, found very little effect of insurance status on the demand for doctor visits. *NSV (1992)* data show that the purchase of different sorts of supplemental health insurance is determined by income and wealth and not by observable health status. The coefficient of the inclusive value from the second level NMNL is estimated to be 0.75 and is very significant. Thus, the consumers' surplus due to VA/non-VA choice has a significant positive effect on veterans seeking outpatient visits. The coefficient estimate 0.75 implies that, conditional on the covariates, the choice between VA and non-VA facilities is more similar than the choice between no visit and some visits. When the inclusive value coefficient is between 0 and 1, it means the model is consistent with global utility maximization, McFadden (1981). The model fit indicator $\overline{R}^2$ is 0.30.

3.4 Count Data Model Estimation for the Total Number of Outpatient Visits.

We next implement our count model for the total number of outpatient visits using the maximum likelihood method. The sample includes all VA and non-VA visits by Medicare-eligible veterans. An out-of-pocket cost index is calculated for each veteran using the allocation model coefficients and formula (2.7). The average consumer surplus per outpatient visit was calculated to be $142 as compared with the average out-of-pocket cost of $189 per visit in the sample, suggesting substantial consumers' surplus on the average. The coefficient estimates are presented in Table 5. The over-dispersion indication parameter α is 0.97 and very significant, which means the number of outpatient visits are over-dispersed. The cost index is also statistically significant, and given the estimated coefficient on out-of-pocket cost, the calculated price elasticity of visit is -0.65.

Other factors that significantly affect veterans' ambulatory care usage are: race, self-rated health condition, family income, home ownership, and various diagnosis health problems. Veterans who are white, have higher family income, or own their homes tend to have less ambulatory health care service. Veterans who are disabled, have service-connected medical conditions, have worse self-rated health status, or have diagnosed HBP, eye, cancer, heart, stomach, rheumatism/arthritis, or mental problems tend to have more outpatient visits. Our estimated effects for many variables including health status, home ownership, gender, education, and marital status are very similar

to those in Deb and Trivedi (1997) and Hurd and McGarry (1997). Calculated marginal effects show that disabled veterans on average have 2.4 more outpatient visits than others; veterans with diagnosed mental problems also have almost 2 more outpatient visits than others. The model fit indicator *Pearson* χ^2 is 3916, which is highly significant[5].

Surprisingly, none of our insurance variables is significant. Many other studies have found that for the general elderly population, more insurance coverage induces more health care utilization (i.e., significant moral hazard effect). In addition, Ettner (1997) found that elderly people with individually purchased policies had additional physician visits (i.e., adverse selection), see also Wolfe and Goddeeris (1991). Thus, our findings on the effect of supplementary private insurance may seem to contradict these previous results. However, elderly veterans in our model have VA as an additional choice alternative compared to the non-veteran elderly population. The VA health care will serve all veterans free of cost in case of catastrophic illnesses if their medical expenditures become large enough to qualify them as medically needy Category A patients. Thus, only relatively wealthy elderly veterans will buy supplemental private insurance, presumably to protect their wealth from unexpected health expenditures, and for additional peace of mind. Our data show that of all veterans without supplemental private insurance coverage, 86 percent belong to Category A, while 84 percent of Category C veterans have supplementary private insurance. In general, Category A veterans

[5]See Cameron *and* Trivedi (1998, Chapter 5) for the definition of the statistic.

do not need to buy any supplementary private insurance because they can get outpatient care services from VA facilities with little or no cost. However, they tend to use more outpatient services (mostly from VA). So even though Medicare-eligible veterans with supplementary private insurance may demand relatively more care from non-VA sources as a result of a pure insurance effect, this positive effect is getting neutralized in our whole sample estimation by the behavior of Category A patients.

Thus, if we take out the VA alternative from our sample of Medicare-eligible veterans and run our NB2 visits regression, we should expect to get results comparable to those in the aforementioned studies. Table 6 reports such a NB2 estimation where we have used only the total number of non-VA visits as the dependent variable. We see that the estimated coefficients on insurance variables INS_BASIC (basic supplementary private insurance coverage) and INS_DRUG (enhanced supplementary private insurance with prescription drug coverage) are positive and significant, and as expected the latter coefficient has a larger value. These results suggest significant moral hazard effects associated with basic supplemental insurance and prescription drug coverage. The estimated coefficients of the insurance variables ADVERSE and ADVERSE+ are still not significant, suggesting no adverse selection effects[6]. Our results underscore the point made by Hurd and McGarry (1997) that the medical expenses of the elderly veterans are so heavily subsidized by a combination of the public health insurance programs that

[6]We obtained very similar results when the NB2 regression was run with visit counts for all Medicare-eligible veterans with no recorded VA visits.

the scope for adverse selection in the private insurance market is extremely limited.

3.5 Policy Simulation

Our model can be used to analyze the impact of certain policy changes on the demand for VA outpatient services. In what follows, we studied the effect of changes in copayment rates for Category C veterans' VA outpatient visits on VA health care utilization.

On December 6, 2001, the Secretary of Veterans Affairs announced that the VA would use a new outpatient copayment schedule that would lower drastically the $50.80 copayment some veterans pay for outpatient care. Congress gave the VA Secretary the authority to change outpatient and medication copayments in Public Law 106-117 (November 1999). The new regulation sets up a three-tier copayment system for outpatient care. The first tier will be for preventive care visits and will cost veterans nothing. This care includes flu shots, laboratory tests, certain radiology services, hepatitis C screenings, and numerous other preventive services. Primary care outpatient visits comprise the second tier and will require a copayment of $15 for Category C patients. This copayment rate was previously $50.80 per visit. The last tier includes specialty outpatient care, like outpatient surgery, audiology and optometry, and will cost $50 per visit. Every dollar collected from outpatient and medication copayments is returned to the VA facility where the veteran received medical care. The aim of the new copayment schedule is

to improve medical care access for all veterans. During fiscal year 2001, the VA collected $95 million as outpatient copayments. Under the new three-tier system, it is estimated that the VA will collect only $30 million, a decrease of 68.4 percent compared with the previous fiscal year.

In Table 7 we have presented changes in the copayment rate for category C patients during FY 1991 to FY 2002. Although the adjustments in each of the years have been relatively small compared to the most recent one in FY 2002, these adjustments are done on a regular basis. Thus, we may expect that the VA may continue to adjust these rates in the future. Our simulation results on the impact of copayment change on expected VA utilization and revenue collection can provide useful reference for future copayment adjustments.

The relation between co-payment rate and health care cost or utilization has been studied before.[7] However, these studies focused on the issue of how an increase in copayment will reduce the cost or utilization in the context of the general insured population. We will evaluate the effect of copayment change on VA health care utilization by elderly veterans whose financial options and incentives can be quite different.

We need to make a detailed classification of Category A and Category C veterans before we simulate the effect of a copayment rate change on VA health care utilization. Category A veterans are generally service-connected or have low income, and it is mandatory for the VA to deliver medically necessary care to them. Category C veterans are generally non-service-connected

[7]See, for instance, Manning *et al.,* 1980; Manning *et al.*, 1987; Kupor *et al.*, 1995; Dalzell, 1997; Magid 1997; and Jung, 1998, to mention a few.

and have high income. Category C veterans are provided care on a space available basis only, and they have to agree to pay copayments.

Category A veterans include:

Priority Group 1: veterans with service-connected conditions rated 50 percent or more disabling;

Priority Group 2: veterans with service-connected conditions rated 30 to 40 percent disabling;

Priority Group 3: veterans who are former Prisoners of Wars, veterans with service-connected conditions rated 10 to 20 percent disabling, veterans discharged from active duty for compensable conditions, veterans awarded special eligibility classification;

Priority Group 4: veterans who are receiving aid and attendance or housebound benefits, veterans who have been determined by VA to be catastrophically disabled.

Priority Group 5: veterans with non service-connected conditions, and veterans with service-connected conditions rated zero percent disabling, whose income and net worth are below the established dollar thresholds[8].

Priority Group 6: all other eligible veterans who are not required to make copayments for their care including World War I and Mexican Border War veterans, veterans receiving care for exposure to toxic substances or environmental hazards while in service, and compensable zero percent service-connected veterans.

[8]The VA means test thresholds in 2002 are: $24,304 with no dependents, $29,168 with one dependent and $1,630 for each additional dependent.

Category C veterans are veterans in Priority Group 7: non service-connected veterans and noncompensable zero percent service-connected veterans with income and net worth above the statutory threshold and who agree to pay specified copayments.

In 1992, about 29 percent of the Medicare-eligible veterans belong to Category C, and about 5 percent of Category C veterans utilized any VA outpatient health care services. One of the reasons for the aggressive reduction in copayment rate in 2002 was to draw more Category C patients to VA outpatient facilities.

Using our estimated model, we can study the effects of a certain reduction (or increase) in copayment on veterans' VA health care demand. We can simulate the changes in the use of outpatient services due to changes in the copayment rate. We can also estimate the change in copayment revenues that VA can expect to collect corresponding to each copayment rate change.

In order to estimate the effect of a certain reduction in the copayment rate of Category C patients on their VA outpatient visits, we will first recalculate the out-of-pocket cost of each outpatient visit for Category C veterans in our sample according to the new rate. We then calculate each individual's new probability of VA outpatient usage following the copayment reduction (using equation 2.2) and the new probability of using any outpatient care using equations 2.3 and 2.4. We next calculate each individual's total amount of outpatient visits using our estimated first stage NB2 model (using equations 2.8 and 2.9). Note that a reduction in copayment affects the inclusive value

via (2.3) and the cost index via (2.7). We compare these three counterfactual variables with the corresponding baseline variables calculated using the original out-of-pocket cost to obtain the percentage change in VA visits due to a particular copayment change. The formula is (superscript "n" denotes new and "o"denotes old rates) :

$$\frac{T_v^n P_{use}^n P_{VA}^n - T_v^o P_{use}^o P_{VA}^o}{T_v^o P_{use}^o P_{VA}^o} \tag{3.1}$$

where T_v^n is the total number of outpatient visits, P_{use}^n is the probability of using any outpatient service, and P_{VA}^n is the conditional probability of using any VA outpatient services - all under the new copayment rate. T_v^o, P_{use}^o, and P_{VA}^o are the corresponding values under the old (baseline) copayment rate. Thus, in our two-stage model, a reduction in copayment generates additional VA outpatient visits through three channels: i) its direct effect on the proportion of VA visits due to the effect on OP-COST (Table 3), ii) its impact on the probability of non-zero outpatient visits via the inclusive values INCLUV (Table 4), and iii) its effect on the total number of outpatient visits via the new COST_INDEX (Table 5), part of which in turn gets allocated to VA visits.

Following this procedure, we calculated the changes in VA visits resulting from a \$5, \$10, and \$20 change in copayment. The simulated results are given in Table 8. We find that corresponding to \$5, \$10, and \$20 reductions in copayments, VA utilization by Medicare-eligible veterans is expected to increase by approximately 4%, 6% and 10% respectively, and it will decrease

by 3%, 5% and 8% with increases in copayments rate by the same amounts. Using a different approach, Gao (1999) estimated that a $5 copayment reduction will result in 3% increase in VA outpatient visits for all veterans.

We also estimated the overall change in copayment revenues collected from Medicare-eligible veterans due to each copayment adjustment. The calculated results are also listed in Table 8. We find that despite increases in outpatient visits, reductions in copayment rates are expected to reduce the total copayment revenue that the VA can expect to collect. This result is broadly consistent with the expectation of the VA that it would lose nearly 68.4% of its copayment revenue when it reduced the copayment rate from $50.80 to $15.00 for Category C patient for FY 2002.

4 Summary and Conclusions.

The VA health care system is the largest national health care delivery system in the United States. It currently serves about 10 to 12 percent of the estimated 26 million veterans. While the number of veterans is decreasing, the proportion of veterans age 65 and older is increasing. These, together with disabled veterans, form a special group - Medicare-eligible veterans - who consume more health care than any other veteran group.

In this study, we empirically analyzed factors that affect Medicare-eligible veterans' use of outpatient health care services and their choice of health care facilities by using a two-stage budgeting approach. This approach has never been used before in health care research. Besides distance, it allows

us to examine the role of out-of-pocket cost in veterans' outpatient facility choice. We also controlled for a large number of factors affecting veterans' outpatient utilization and facility choice. We estimated the marginal effects and elasticities for many policy relevant variables after controlling for the exogenous factors.

Our main findings are:

Veterans are more likely choose the outpatient facility with smaller out-of-pocket cost, other things equal. The distance to the nearest VA health care facility is very important in veterans' decision of facility choice. Other attributes which significantly affect veterans' visits allocation are their insurance status, income level, modes of transportation, home ownership, age, race, employment, and various health status variables. Veterans who are covered for prescription drugs by private insurance or covered by Medicare Part B or Medigap are less likely to use VA outpatient service compared to others. Thus, an across-the-board coverage of prescription drugs by Medicare is expected to reduce the demand for VA outpatient visits. Veterans with lower incomes have high probabilities of VA outpatient visits. Also, veterans who are disabled or diagnosed with mental and other chronic problems are more likely to use VA outpatient facility.

Factors that significantly affect veterans' total outpatient visits are shadow cost index, health condition, family income, and several diagnostic problems. The cost elasticity of total outpatient visits is about -0.65 and is highly significant. Since the Veterans' Survey data contained information not only on

the extent of supplemental private insurance coverage, but also on whether it was directly purchased rather than obtained through an employer, we could distinguish between moral hazard and adverse selection effects on the demand for total outpatient visits. We find some evidence of moral hazard effect in the market for private supplemental health insurance and prescription drugs, but adverse selection does not seem to a problem for this special population. Calculated marginal effects show that disabled veterans on average have 2.4 more outpatient visits per year, and veterans with diagnosed mental problems have 2 more outpatient visits than others.

We used the estimated model to simulate the impact of copayment rate changes for Category C veterans on the demand for VA health care services. We show that in our model such a policy change will affect the total number of VA outpatient visits through a number of reinforcing channels. According to our calculations, \$5, \$10, and \$20 copayment reductions will increase VA utilizations by 4%, 6%, and 10% respectively, while copayment increases of similar magnitudes will decrease VA utilizations by 3%, 5%, and 8% respectively. The estimated cost elasticities are such that reductions in copayments are expected to lead to substantial loss of revenues to the VA. Since copayment rates are changed often as a policy tool, our estimates can provide the VA with a benchmark against which the financial implication of such policy changes can be gauged.

Table 1: Percentage of Medicare-eligible Veterans Using VA and non-VA facilities, by Various Characteristics

Characteristics		% Using VA	% Using non-VA	% Non-users
Income	$\leq$\$20,000	34	39	27
	>\$20,000	9	67	24
Race	White	21	54	25
	Other	37	36	27
Disability	Disabled	31	50	19
	Non-disabled	8	55	37
Category	Category A	31	46	23
	Category C	5	63	32

Table 2: Definition of Variables

Variable	Definition	Mean
AGE	Veteran's age. AGESQ is square of age	67.13
SEX	Gender. 1 if male, 0 if female	0.97
DISABLE	Disability status. 1 if disabled, 0 otherwise	0.64
EDU_HIGH	Level of education: BA or higher =1, 0 otherwise	0.17
EMP_FT	Full-time employed=1, other=0	0.05
WHITE	White=1, other=0.	0.90
BADHLTH	Self-evaluated health: bad, worse=1, other=0	0.46
GOODHLTH	Self-evaluated health: excellent, good=1, other=0	0.28
LOWINC	Family income. =1, if $0-$20,000, other=0	0.57
MARRIED	Marital status: married=1, other=0.	0.80
DIS_RATE	Disability rating.	0.13
OWNHOME	1 if owns home, 0 if not.	0.85
DIST_VA	Distance to VA outpatient facilities (100 miles)	0.40
DIST_NVA	Distance to Non-VA outpatient facilities (100 miles)	0.06
OP_COST	Out-of-pocket cost for each outpatient visit ($)	189.43
CAT_C	1 if belongs to category C, 0 otherwise.	0.29
DIS_SC50	1 if service-connected disability rate>50 %, 0 other	0.11
CAR	1 if mode of transportation to VA is car, 0 other	0.20
SCMEDC	1 if eligible for VA medical care for service-connected conditions, 0 otherwise	0.42
INS_PRTB	1 if covered by Medicare Part B, 0 otherwise	0.94
MEDIGAP	1 if covered by Medigap, 0 otherwise	0.34
INS_BASIC	1 if private insurance did not cover prescription drug, 0 otherwise	0.28
INS_DRUG	1 if private insurance also cover prescription drugs (called enhanced coverage), 0 otherwise	0.38
ADVERSE	1 if have basic supplementary private insurance but no enhanced coverage through non-employer, 0 otherwise	0.55
ADVERSE+	1 if enhanced coverage through a non-employer source (such as AARP) or purchased directly, 0 otherwise	0.11

Table 2: Definition of Variables (continued)

HBP	Diagnosed condition: High blood pressure	0.51
HEAR	Diagnosed condition: Hearing problem	0.42
EYE	Diagnosed condition: Eye or vision problem	0.32
CANCER	Diagnosed condition: Cancer	0.19
HEART	Diagnosed condition: Heart trouble	0.40
STROKE	Diagnosed condition: Stroke	0.13
RHEU	Diagnosed condition: Rheumatism or arthritis	0.46
STOMACH	Diagnosed condition: Stomach/Digestive disorder	0.28
SUBABUSE	Diagnosed condition: Substance abuse	0.03
MENTAL	Diagnosed condition: Mental /Emotional problem	0.10
ACCIDT	Diagnosed condition: Accident related injury	0.19
DIGOTH	Diagnosed condition: Other serious conditions	0.15

Table 3: Nested Logit estimation: Allocation model
Second Level NMNL: Non_VA vs. VA

Variable	Coeff.	|t-ratio|	m-effect
CONST	8.43	9.46	
OP-COST	-0.013	39.59	*
DISTANCE	-0.45	3.73	*
AGE$\times 10^{-2}$	-14.07	4.79	-0.51
AGESQ$\times 10^{-4}$	14.24	5.71	0.52
SEX	0.04	0.17	0.00
DISABLE	-0.70	4.43	-0.03
BADHLTH	0.04	0.59	0.00
DIS_SC50	0.20	1.47	0.01
SCMEDC	-0.44	3.63	-0.02
EDU_HIGH	-0.20	1.76	-0.01
EMP_FT	1.43	4.11	0.05
WHITE	0.89	6.48	0.03
LOWINC	-0.91	7.26	-0.03
MARRIED	0.16	1.23	0.01
OWNHOME	1.02	8.20	0.04
CAR	-4.47	38.18	-0.16
CAT_C	0.31	1.49	0.01
MEDIGAP	0.45	3.73	0.02
INS_PRTB	0.91	4.96	0.03
INS_DRUG	0.68	5.10	0.03
HBP	-0.46	4.66	-0.02
HEAR	0.04	0.59	0.00
EYE	-0.44	4.33	-0.02
CANCER	-0.29	2.45	-0.01
HEART	-0.21	2.14	-0.01
RHEU	-0.05	0.51	0.00
STOMACH	-0.37	3.61	-0.01
SUBABUSE	1.03	4.31	0.04
MENTAL	-0.36	2.70	-0.01
ACCIDT	-0.50	4.54	-0.02
DIGOTH	0.03	0.21	0.00

*Cost and distance are alternative specific, so instead of calculating their m-effects, we calculated their elasticities. Model fit indicator $\overline{R}^2 = 0.81$, n=15147 patient visits.

Table 4: Nested Logit estimation: Allocation model
First Level NMNL: Decision of Use vs. not-Use

Variable	Coeff.	|t-ratio|	m-effect
CONST	-0.95	0.53	
AGE$\times 10^{-2}$	3.69	0.66	0.43
AGESQ$\times 10^{-4}$	-4.64	1.05	-0.53
SEX	-0.42	1.11	-0.05
DISABLE	0.92	6.36	0.11
EDU_HIGH	0.35	2.01	0.04
EMP_FT	-0.79	2.90	-0.09
WHITE	-0.08	0.40	-0.01
BADDHLTH	-0.01	0.05	0.00
LOWINC	0.12	0.75	0.01
MARRIED	-0.01	0.01	0.00
OWNHOME	–0.42	2.46	-0.05
DIS_RATE	0.01	3.80	0.00
CAT_C	-0.89	5.27	-0.10
INS_BASIC	-0.05	0.18	-0.01
INS_DRUG	-0.51	1.88	-0.06
ADVERSE	-0.27	1.08	-0.03
ADVERSE+	-0.39	1.59	-0.05
HBP	0.43	3.69	0.05
HEAR	0.23	1.86	0.03
EYE	0.18	1.38	0.02
CANCER	0.38	2.40	0.04
HEART	0.18	1.44	0.02
RHEU	0.38	3.09	0.04
STOMACH	0.51	3.51	0.06
SUBABUSE	-0.21	0.59	-0.02
MENTAL	0.87	3.19	0.10
ACCIDT	0.68	4.14	0.08
DIGOTH	-0.02	0.10	0.00
INCLUV	0.75	18.64	0.09
	$\overline{R}^2 = 0.30$, n=2535 veterans		

Table 5: NB2 Estimation of Total OP Visits Equation

Variable	Coeff.	|t-ratio|	m-effects
CONSTANT	1.13	2.52	
COST_INDEX	-0.003	20.95	-0.02
AGE$\times 10^{-2}$	-0.28	0.16	-1.77
AGESQ$\times 10^{-4}$	-0.53	0.38	-3.42
SEX	-0.06	0.39	-0.37
DISABLE	0.37	6.23	2.36
EDU_HIGH	-0.01	0.14	-0.05
EMP_FT	-0.09	0.83	-0.57
WHITE	-0.32	5.06	-2.04
BADHLTH	0.22	4.48	1.39
LOWINC	0.12	2.21	0.74
MARRIED	0.04	0.78	0.27
OWNHOME	-0.16	2.74	-1.05
DIS_SC50	-0.04	0.60	-0.30
SCMEDC	0.24	4.79	1.55
CAT_C	0.06	0.98	0.40
INS_PRTB	0.05	0.53	0.35
INS-BASIC	-0.06	0.62	-0.41
INS_DRUG	-0.14	1.52	-0.90
ADVERSE	-0.07	0.76	-0.44
ADVERSE+	-0.06	0.64	-0.38
HBP	0.16	3.74	1.06
HEAR	0.06	1.27	0.36
EYE	0.12	2.70	0.77
CANCER	0.20	3.91	1.28
HEART	0.07	1.48	0.43
RHEU	0.05	1.08	0.31
STOMACH	0.10	2.02	0.62
SUBABUSE	0.01	0.07	0.05
MENTAL	0.30	3.91	1.92
ACCIDT	-0.08	1.43	-0.49
DIGOTH	0.26	4.86	1.69
α	0.97	29.85	
-LOGL=6692, $Pearson\ \chi^2$=3916, $Deviance$= 636			

Table 6: NB2 Estimation of Non-VA OPVisits

Variable	Coeff.	|t-ratio|	m-effects
CONSTANT	3.56	3.66	
AGE$\times 10^{-2}$	-8.34	2.62	33.30
AGESQ$\times 10^{-4}$	6.02	2.36	24.06
SEX	-0.47	2.12	-1.86
DISABLE	0.40	4.04	1.61
EDU_HIGH	0.26	2.35	1.04
EMP_FT	0.06	0.33	0.23
WHITE	0.09	0.93	0.38
BADHLTH	0.29	3.41	1.15
LOWINC	-0.31	3.45	-1.22
MARRIED	0.00	0.02	0.01
OWNHOME	0.10	0.91	0.38
DIS_SC50	-0.17	1.38	-0.69
SCMEDC	0.27	3.18	1.09
CAT_C	0.10	0.99	0.79
INS_PRTB	-0.52	2.57	-2.06
INS_BASIC	0.42	2.41	1.67
INS_DRUG	0.57	3.66	2.28
ADVERSE	0.07	0.44	0.28
ADVERSE+	-0.19	1.23	-0.74
HBP	0.15	1.99	0.58
HEAR	0.18	2.39	0.72
EYE	0.13	1.63	0.51
CANCER	0.33	3.56	1.30
HEART	0.20	2.53	0.81
RHEU	0.35	0.45	0.14
STOMACH	0.14	1.68	0.55
SUBABUSE	-0.07	0.40	-0.28
MENTAL	0.23	1.49	0.90
ACCIDT	0.18	1.91	0.70
DIGOTH	0.32	3.22	1.26
α	2.27	27.02	
-LOGL=5692, *Pearson* χ^2=2611, *Deviance*=334			

Table 7: VA Copayment Rates

FY 1991	$26.00
FY 1992	$30.00
FY 1993	$33.00
FY 1994	$36.00
FY 1995	$39.00
FY 1996	$41.00
FY 1997	$38.80
FY 1998	$38.80
FY 1999	$45.80
FY 2000	$50.80
FY 2001	$50.80
FY 2002	$15.00

Table 8: Effects on VA Utilizations and Copayment Revenues due to Changes in Copayments

Change in copayments	Change in VA outpatient visits (%)	Change of copayment revenue collected by VA (%)
-$20	9.6	-63.3
-$10	5.7	-29.3
-$5	3.5	-13.3
+$5	-2.6	13.2
$10	-4.5	26.7
$20	-7.6	53.3

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